COMMUNITY OF GOGAMA
GROUND WATER SURVEY

1980

Ministry
of the
Environment

Ontario

The Honourable
Harry C. Parrott, D.D.S.,
Minister

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MINISTRY OF THE ENVIRONMENT

COMMUNITY OF GOGAMA

GROUND WATER SURVEY

D.J. ANDRIJIW

1980

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COMMUNITY OF GOGAMA

GROUND WATER SURVEY

INTRODUCTION

At the request of the Project Manager of the Northeastern Region of the Project Co-ordination Branch, a ground water survey was undertaken to determine the feasibility of utilizing local ground water resources as a source of water supply for a communal water system. If the ground water conditions proved to be favourable, potential test-drilling sites would be indicated.

The study was confined to an area within a radius of about 3 km of the Community of Gogama. An office study consisted of reviewing water-well records, topographic maps, geological reports, and aerial photographs. A field reconnaisance was made to observe geologic and topographic features. Water samples were collected from both the bedrock and overburden wells in the vicinity to determine the chemical quality of ground water in the area.

The water well records of the study area are listed in Table 1. The location of representative wells is shown in Figure 1. The well numbering system used in this report relates to the permanent well coding numbers of the Ministry of the Environment.

PRESENT SUPPLIES AND WATER REQUIREMENTS

Residents within the study area obtain water supplies from individual sand points and from drilled wells which terminate in the overburden or the bedrock. Also, two small communal water systems utilizing lake water supply a limited number of residents. The Ministry of Natural Resources system supplies water to their office complex and residents living on M.N.R. property. The Canadian National Railway water system supplies some homes and businesses whose wells were contaminated froman accidental chemical tank car spill in the area.

The population of Gogama is approximately 800 and may attain a population of 1000 in a 20-year span. Assuming a maximum-day to average-day demand ratio of 2.5 to 1 and an average daily consumption of 455 litres per person, a well water supply capable of yielding 5.3 L/s on an average-day basis and 13.2 L/s on a maximum-day basis is required for the design period. Storage would be required to meet peak-hourly

and fire-flow demands.

GEOLOGY

Bedrock

The bedrock underlying the study area is the early Precambrian of the Canadian Shield. The bedrock is felsic intrusive rocks and consists of trondhjenite, granodiorite, quartz monzonite, quartz diorite, aplite, pegmatite and migmatite.[1] The bedrock outcrops in several locations in the study area, predominantly to the north of Gogama. According to the bedrock well records and topographic map, the bedrock surface is partly reflected by the topography and is moderately to highly undulating. The bedrock appears to form two possible bedrock valleys or channels. One of these channels is located at the western portion of Gogama and runs from Minisinakwa Lake near Poplar Point northward towards Frigid Lake. Another possible bedrock channel runs from Minisinakwa Lake northwestwards towards Farm Lake.

Overburden

The overburden in the study area consists of Pleistocene sediments of glacial, glaciofluvial and eolion origin deposited over most of the area during Wisconsinan glaciation. The Community of Gogama is situated on a deposit of predominantly outwash sands. The surface sands range in depth from 6.1 m to 16.8 m. The surficial sands are underlain by gravel and course sand and gravel deposits which attain a thickness of up to 6.4 m. Three water well records indicate that a clay or a clay and sand deposit of up to 8.8 m in thickness underlies the surficial sands. The clay deposit may be underlain by sands and/or gravels in some areas.

Eolian deposits of fine sand form a ridge on the north shore of Minisinakwa Lake at the community. The ridge overlies the outwash sand deposits and attains a height of up to 4 m.

The area between Highway 661 and the C.N.R. tracks and just north of the community consists of a sandy, boulder till which varies in thickness. No wells have been drilled to indicate the greatest thickness of the till.

[1] Pyke, D.R., Ayres, L.D., and Innes, D.G.
1973: Timmins-Kirkland Lake, Cockrane, Sudbury, and Timiskaming Districts, Ontario Division of Mines, Map 2205, Geological Compilation Series.

Sand and gravel deposits of glaciofluvial origin are found in the esker ridges located to the northwest of Gogama. The esker deposits are of variable thickness and attain thicknesses of at least 15 m.

The maximum thickness of the overburden materials reported in the available water well records is 25 m.

In general the stratigraphic sequence in the Gogama area comprises surface sands that overlies gravels and sand and gravels which in turn overlie the bedrock.

HYDROGEOLOGY

General

A rock formation or unconsolidated sediments which can yield usable quantities of water is called an aquifer. The ability of an aquifer to yield water is dependent upon its hydraulic characteristics, its thickness and areal extent, and on the amount of recharge in the form of precipitation which reaches the aquifer.

The piezometric or water pressure level contours drawn from the area well data indicate that there is a piezometric high to the north of Gogama. The flow gradients are generally towards the south and southeast to Minisinakwa Lake.

Bedrock

Water in the bedrock moves primarily through interconnected openings such as fractures, joints and bedding planes. Water in interconnected, intergranular pore spaces contribute to storage in the aquifer rather than well yield. The yield from a bedrock well is generally dependent upon the number, size and interconnection of the openings which the well intercepts. As a well penetrates deeper into the bedrock formation, more solution cavities and/or fractures may be intersected.

Of the 31 water well records utilized for the study, 10 indicate that the wells were completed into the bedrock. Penetration into the bedrock varied from 0.3 m to 45.4 m. From the well data it is seen that 80% of the domestic wells encounter sufficient water supplies within the upper 15 m of bedrock formation.

Specific capacity, which is the well yield in litres per second per metre (L/s/m) is a measure of the ability of a well to yield water. The specific capacities of the bedrock wells vary from 5.0×10^{-2} to 6.8×10^{-1} L/s/m with about 55% of the bedrock wells having a specific capacity of less than 1.2×10^{-1} L/s/m. Four of the

bedrock wells penetrate less than 3 m into the bedrock and may be hydraulically connected to the basal sand and gravel formation.

Overburden

In the overburden, water is transmitted through inter-granular openings in the sediments, and hence, the sorting, shape and grain size of the overburden materials affect its ability to transmit water. Water movement through glacial materials varies greatly. Water movement is slow in both vertical and horizontal directions through fine-grained materials such as clay or poorly sorted materials such as till, due to the low permeability of the materials. These materials tend to form poor aquifers. Coarse-grained materials such as sands and gravels have high permeabilities and can be fair to excellent aquifers.

The logs of the water wells indicate that water is present in the surficial sands and in sands and gravels overlying the bedrock. Over half of the residents in the study area reportedly utilize sand points for water supply purposes. These wells are generally less than 8 m deep and usually have sufficient yields for domestic supplies.

Large diameter drilled wells completed in the overburden range in depth from 9.1 m to 25 m. All of the wells terminate in a deeper sand and gravel or gravel formation. The formation logs suggest that the surface sands and the deeper gravels are generally the same hydraulic unit. In three water well records a clay or clay and sand layer are reported and may be an aquitard. However, the static water level in these wells corresponds to other area wells.

The well data indicate that the surficial sand and the lower sand and/or gravel are extensive in area and tend to have a substantial saturated thickness ranging from approximately 7.9 to 21.3 m.

The specific capacities of the overburden wells range from 1.0×10^{-2} L/s/m to a high of 9.9×10^{-1} L/s/m. Approximately 70% of the drilled overburden wells in the Gogama area have specific capacities of less than 1.2×10^{-1} L/s/m. These rather low specified capacities in apparently coarse formations may be attributed to the type of well construction used for domestic wells. Well yields and specific capacities can

be increased where gravel-packed or naturally developed wells are properly constructed and where large thicknesses of the aquifer are screened.

CHEMICAL WATER QUALITY

Fifteen water samples were collected to assess the chemical quality of the ground water in the overburden and the bedrock. The results of the analyses are shown in Table 2.

Four of the fifteen water analyses results indicate that the iron concentration exceeds the Ministry of the Environment's permissible criterion of 0.3 mg/L. Iron concentrations range from $<$0.05 to 2.85 mg/L in the overburden sands and gravels while in the bedrock wells the range is between $<$0.05 to 0.38 mg/L.

The high colour and turbidity results observed in two of the well water samples are probably related to the high iron content in the water.

Hardness values for the wells terminating in the overburden aquifer range between 67 and 282 mg/L while in bedrock wells the hardness values range from 39 to 194 mg/L. Both aquifers yield hard to very hard waters.

From all of the samples collected, the total dissolved solids range from 45 to 695 mg/L. Only two of these samples exceed the Ministry's criterion of 500 mg/L, with one of the samples coming from the overburden aquifer.

The chloride concentration in two of the samples exceeds the Ministry's permissible criterion of 250 mg/L. The high chloride is related to winter road salting and possible septic tile field effluent.

The nitrate concentration in one sample exceeds the Ministry's permissible criterion of 10 mg/L while in another sample the nitrate approaches the permissible criterion. The remaining samples contain nitrates of acceptable levels. However, a nitrate problem has been identified in the Gogama area and has been investigated and reported in the past. The main sources of this type of contamination are suspected to be septic tile effluent, animal wastes and nitrogen fertilizers.

FAVOURABLE TEST DRILLING AREAS

On the basis of the available hydrogeologic data, the areas shown in Figure 1 appear to be the most favourable for testing. These areas are generally located hydraulically upgradient from the majority of the wells in Gogama to avoid the present water quality

problems. These areas are also located generally in the possible bedrock channels where thick sections of possibly saturated sands and gravels are encountered overlying the bedrock. Any test wells drilled in these areas should penetrate the entire thickness of the overburden.

CONCLUSIONS

Ground water conditions in Gogama appear favourable for developing a municipal well water supply capable of yielding 13.2 L/s. A test drilling program is warranted to confirm conditions. Favourable water-bearing formations occur in the overburden. The bedrock does not form a favourable aquifer for the construction of a large capacity production well. Test drilling areas are indicated.

Supplies of ground water of acceptable chemical quality might be developed from the sand and/or gravel formation found at depth. However, the water obtained from the aquifer may require treatment for iron.

RECOMMENDATIONS

It is recommended that any test drilling program in Gogama be carried out in the areas outlined in this report.

Extended pumping tests should be carried out on any test wells encountering favourable formation to determine their capacity, changes in chemical water quality with respect to pumping time and the anticipated amount of interference in nearby wells.

The degree of treatment of the water would be determined from the results of the chemical analyses of the water samples obtained during the testing.

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GROUND WATER DEVELOPMENT SECTION

STANDARD ABBREVIATIONS

Materials

Bldr - boulders
Cl - clay
Gr - gravel
Hp - hardpan
Pbl - pebble
Qsd - quicksand
Sd - sand
Slt - silt
Stns - stone(s)
Ts - topsoil
Cht - chert
Dol - dolomite
Gte - granite
Gnst - greenstone
Ls - Limestone
Rk - rock and bedrock
Sh - shale
Sdst - sandstone
Qtz - quartz

Water Use

Ab - abandoned
C - commercial
D - domestic
In - industrial
Irr - irrigation
M - municipal
P - public supply
S - stock
TH - test hole
TW - test well

Description

Cem - cemented
Cln - clean
Clr - clear
Cly - Clayey
Cse - coarse
Dk - dark
Dty - dirty
Lt - light
F - fine
Fr - fresh
Gry - gravelly
Med - medium
Hd - hard
Lay - layer(s)
Lse - loose
Lge - large
Min - mineral
Sa - salty
Sdy - sandy
Shy - shaly
Slty - silty
Sm - small
Sf - soft
Str - streak(s)
Sty - stony
S - sulphur
Bf - buff
Bk - black
Bl - blue
Bn - brown
Gn - green
Gy - grey
Pk - pink
W - water or water-bearing
Wh - white
Yl - yellow

TABLE OF SYMBOLS

GROUND WATER DEVELOPMENT SECTION

● Drilled well in overburden

Drilled well in bedrock

Abandoned drilled well or well site in overburden

Abandoned drilled well or well site in bedrock

Flowing drilled well in overburden

Flowing drilled well in bedrock

Abandoned flowing drilled well or well site in bedrock

Abandoned flowing drilled well or well site in overburden

■ Bored or dug well

□ Abandoned bored or dug well or well site

▼ Well point

▽ Abandoned well point or well-point site

◉ Drilled municipal well in overburden

Drilled municipal well in bedrock

Flowing drilled municipal well in overburden

Flowing drilled municipal well in bedrock

◎ Abandoned drilled municipal well in overburden

Abandoned drilled municipal well in bedrock

Abandoned flowing drilled municipal well or well site in overburden

Abandoned flowing drilled municipal well or well site in bedrock

o Test hole

Spring

✳ Depth at which water was found

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TABLE SUMMARY OF WATER WELL RECORDS

Well No.	Location and Elevation (M.S.L.)	Con.	Lot	Owner	Well Contractor Year Completed	Well Type or Source	Well Diameter (in)	Total Well Depth (ft)	Total Cased Depth (ft)	Pumping Test Results: Rate (gpm) / (Hrs) Duration	Pumping Test Results: Static Water Level (ft)	Pumping Test Results: Pumping Level (ft)	Well Screen: Length (ft)	Well Screen: Diameter (in)	Well Screen: Slot Size ( )	Water Quality	Use	Geologic Log, Remarks
1242	JACK 1125			D.H.O	GROLEAU 66	†	2	203	58	8/12	14	40	/	/	/	FR	C D	0 sd 38 sd&bldr 54 gnte 203 *157
2821	1200			IMPERIAL OIL	SUDBURY 72	†	6	52	51	15/2	12	30	/	/	/	Fe	C	0 grvl 8 sd 30 grvl&sd 45 grvl 51 gnte 52 *51
2822	1150			S. KRASUSKI	SUDBURY 72	●	6	82	82	15/1½	12	20	/	/	/	Fe	C	0 sd 35 cl 60 cl&bldr 81 grvl 82 *82
3315	1150			IMPERIAL OIL	VAILLANCOURT 74	●	6	67	67	10/2	10	67	/	/	/	FR	D	0 sd 25 sd&grvl 60 grvl 67 *67
3322	1170			M.R. SMITH	VAILLANCOURT 75	●	6	34	34	6/2	17	34	/	/	/	FR	D	0 sd 30 grvl 34 *34
3323	1160			M. CHARBONNEAU	VAILLANCOURT 75	●	6	42	42	10/2	17	35	/	/	/	FR	D	0 sd 40 grvl 42 *42
3324	1165			F. FREE	VAILLANCOURT 75	●	6	56	56	10/3	17	40	/	/	/	FR	D	0 sd 50 grvl 56 *56
3333	1160			E. LARENTE	VAILLANCOURT 75	●	6	51	51	4/24	12	13	/	/	/	FR	D	0 sd 49 grvl 51 *51
3334	1160			J. BLANCHETTE	VAILLANCOURT 75	●	6	57	57	10/2	10	50	/	/	/	FR	D	0 sd 55 grvl 57 *57
3335	1160			C. CONSTANTIN	VAILLANCOURT 75	●	6	46	46	10/4	12	35	/	/	/	FR	D	0 sd 45 grvl 46 *46
3337	1160			J. CLOUTIER	VAILLANCOURT 75	●	6	38	38	5/2	13	38	/	/	/	FR	D	0 sd 35 grvl 38 *38
3339	1160			CONSTANT TERACO	VAILLANCOURT 75	●	6	35	35	5/2	13	35	/	/	/	FR	D	0 sd 24 sd&grvl 34 grvl 35 *35

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3340	1160			J. HIBAULT	VAILLANCOURT 75	●	6	50	50	10 / 12	4	40	/	/	/	Fr	D	0 sd 45 grvl 50 *50
3487	1150			VAGABOND ESSO	VAILLANCOURT 75	●	8	41	41	15 / 1	15	30	/	/	/	Fr	C	0 grvl 7 sd 35 grvl 41 *41
3489	1160			A. CONSTANT	VAILLANCOURT 75	●	6	42	42	3 / 3	15	42	/	/	/	Fr	D	0 sd 41 sd & grvl 42 *42
1466	NOBLE 1175			R.C. CHURCH	GROLEAU 61	●	2	60	60	6 / 8	7	—	/	/	/	Fr	D	0 fnsd 51 crsgrvl & bldr 60 *57
1467	1175			GOGAMA SEPARATE SCHOOL	GROLEAU 61	⚲	2	68	58	5 / 4	10	—	/	/	/	Fr	D	0 fnsd 42 crs grvl 56 brk 68 *60
1468	1175			DEPT. OF LANDS & FORESTS	GOODBERRY 61	⚲	5	76	67	25 / 3	17	50	/	/	/	Fr	D	0 tp 1 sd 45 bldr & sd 60 grvl 65 grte 76 *70
1469	1175			DEPT. OF LANDS & FORESTS	GOODBERRY 61	⚲	6½	70	66	30 / 14	9	20	/	/	/	Fr	D	0 sd 63 grte 70 *65
1470	1175			ONTARIO PROVINCIAL POLICE	GOODBERRY 61	⚲	6½	135	61½	½ / ½	19	133	/	/	/	Fr	D	0 sd 45 bldr & sd 59 gy grte 75 rd grte 80 bl grte 135 *80
1471	1175			DEPT. OF LANDS & FORESTS	GOODBERRY 61	⚲	6½	73	36	10 / 1	10	60	/	/	/	Fr	D	0 sd 36 gy grte 73 *45
1472	1175			DEPT. OF LANDS & FORESTS	GOODBERRY 61	⚲	6½	100	67	10 / 4	19	50	/	/	/	Fr	D	0 sd 26 sd & cl 65 gy grte 100 *98

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Well No.	Location and Elevation (M.S.L.)	Con.	Lot	Owner	Well Contractor Year Completed	Well Type or Source	Well Diameter (in)	Total Well Depth (ft.)	Total Cased Depth (ft)	Pumping Test Results: Rate (gpm) / Duration (Hrs)	Static Water Level (ft)	Pumping Level (ft)	Well Screen: Length (ft)	Diameter (in)	Slot Size ( )	Water Quality	Use	Geologic Log, Remarks
1473	1175			DEPT. OF LANDS & FORESTS	GOODBERRY 61	●	6½	50	48	10/16	9	45	/	/	/	FR	D	0 sd 45 gr gnte 50 *47
1474	1175			DEPT. OF LANDS & FORESTS	GOODBERRY 61	●	6½	60	54	10/1	14	50	/	/	/	FR	D	0 sd 50 gnte 60 *58
3321	1160			R. GAUDETTE	VAILLANCOURT 75	●	6	60	60	5/3	17	60	/	/	/	FR	D	0 sd 55 grvl 60 *60
3331	1175			R. DUQUAY	VAILLANCOURT 75	●	6	69	69	10/2	12	40	/	/	/	FR	D	0 sd 55 sd & grvl 67 grvl 69 *69
3332	1160			D. THEBEAULT	VAILLANCOURT 75	●	6	52	52	10/3	12	50	/	/	/	FR	D	0 sd 25 sd & cl 50 grvl 52 *52
3336	1170			L. MARCEAU	VAILLANCOURT 75	●	6	65	65	10/24	12	20	/	/	/	FR	D	0 sd 55 grvl 65 *65
3338	1160			L. CHENIER	VAILLANCOURT 75	●	6	65	65	2/3	13	65	/	/	/	FR	D	0 sd 64 grvl 65 *65
3341	1150			W. FRASER	VAILLANCOURT 75	●	6	30	30	10/2	9	25	/	/	/	FR	D	0 sd 20 hp 22 sd 28 grvl 30 *30
3488	1170			R.C. CLIFFORD	VAILLANCOURT 75	●	6	57	57	10/1	15	50	/	/	/	FR	D	0 sd 50 grvl 57 *57

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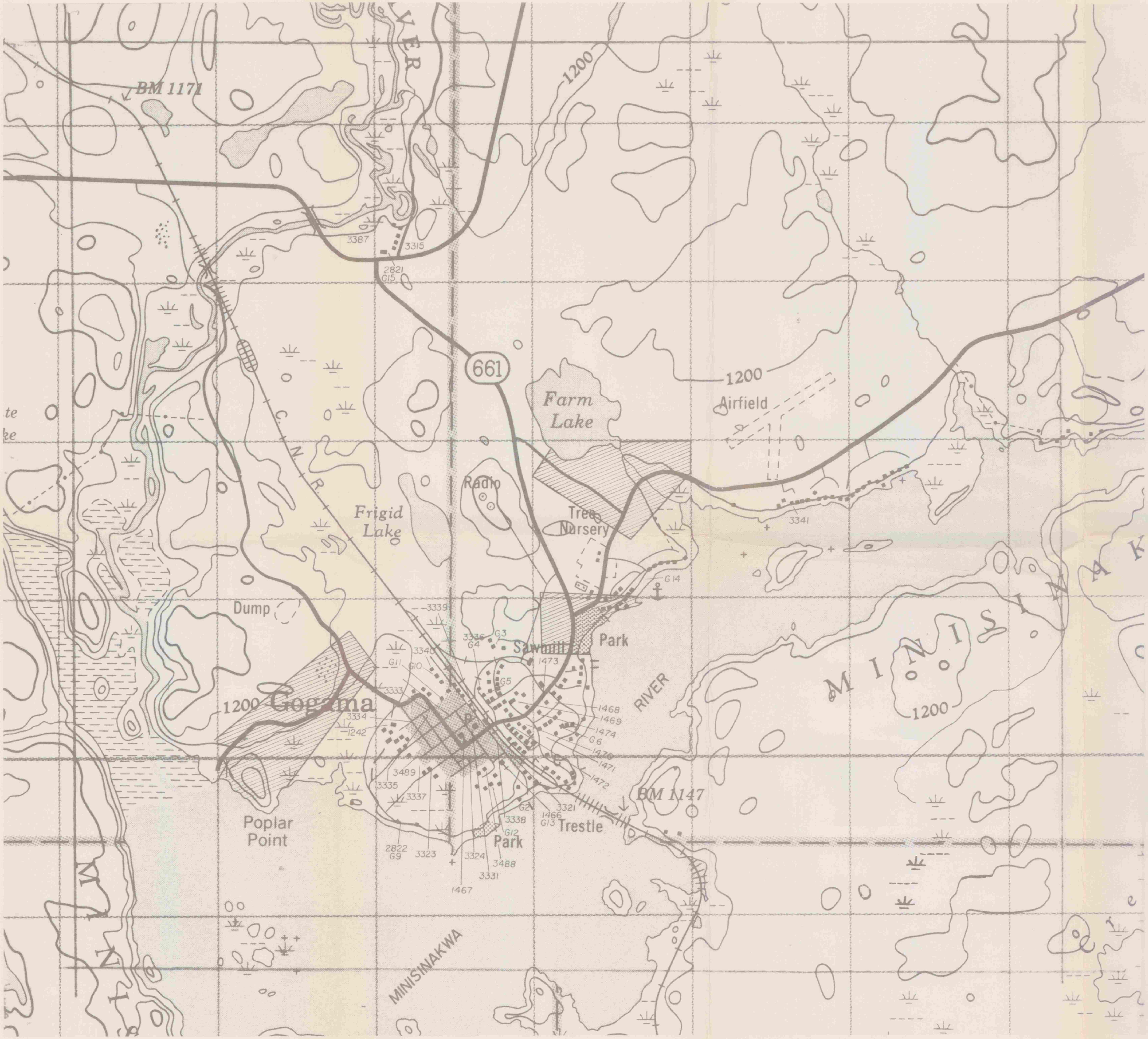
TABLE 2 SUMMARY OF CHEMICAL ANALYSES OF WATER

All analyses except pH reported in mg/l unless otherwise indicated

Source and Number	Location	Date Sampled	pH at Lab	Apparent Colour in Hazen Units	Turbidity in Formazin Units	Specific Conductance in µmhos/cm at 25°C	Total Dissolved Solids	Total Hardness as $CaCO_3$	Alkalinity as $CaCO_3$	Chloride (Cl)	Sulphate (SO_4)	Iron (Total) (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Nitrogen as N: Free Ammonia	Nitrogen as N: Total Kjeldahl	Nitrogen as N: Nitrite	Nitrogen as N: Nitrate	Dissolved Organic Carbon	Total Phosphorus as P	Arsenic as As
CHEZ MATHILDA RESTAURANT	GOGAMA	OCT. 30/79	6.0	5.4	.81	1190	660	154	30	311	37	.11	54	5	165	11.8	2.3	2.8	.03	9.6	2.6	.02	<.001
MINISINAKWA LAKE	"	"	6.9	4.9	1.2	69	45	32	26	1	8	.20	13	<1	2	0.4	<.1	0.6	<.01	<.1	7.3	.02	<.001
W. LAWSON	"	"	7.9	2.7	.55	155	100	78	72	<1	10	<.05	22	6	3	0.8	<.1	0.2	<.01	<.1	0.6	.02	<.001
L. MARCEAU	"	"	7.6	73	.72	416	270	216	163	14	48	2.85	60	16	7	1.0	<.1	0.4	<.01	<.1	3.6	.04	<.001
E. CHENIER	"	"	7.0	2.7	.90	275	175	67	27	46	18	.05	20	4	21	8.4	<.1	0.4	<.01	4.5	1.0	.08	<.001
E. ROKOSS	"	"	8.2	<1	.76	245	160	105	85	18	11	.07	34	5	10	0.5	<.1	0.2	<.01	1.5	0.7	.24	<.001
M.T.C.	"	"	8.0	2.9	2.6	488	320	194	120	78	13	.28	60	10	19	1.8	.4	0.8	<.01	<.1	1.2	.02	<.001
CATHOLIC SCHOOL	"	"	7.5	20	1.9	102	65	39	36	7	8	.16	15	<1	6	0.4	<.1	0.4	<.01	<.1	5.2	.02	<.001
S. KRASUSKI	"	"	8.1	<1	.99	289	180	125	86	16	16	<.05	38	8	8	1.4	<.1	0.2	<.01	5.2	0.4	.04	<.001
E. LAVOIE	"	"	6.2	<1	1.3	260	170	.99	25	26	55	.32	39	1	11	2.6	<.1	0.2	<.01	.4	1.2	.02	<.001
L. MATHIEU	"	"	7.4	27	5.0	360	235	178	126	12	45	1.4	48	14	6	1.0	<.1	0.2	<.01	<.1	2.1	.02	<.001
C. INGRAM	"	"	7.5	2.7	.61	675	450	266	165	47	25	<.05	95	7	40	0.9	<.1	0.2	.01	28	1.4	.02	<.001
R.C. CHURCH	"	"	7.6	2.7	.79	635	465	282	196	38	37	<.05	81	20	47	3.6	<.1	0.2	.01	6.2	2.6	.02	<.001
D.E. MUNRO	"	"	8.0	2.6	2.2	344	225	131	92	37	29	.38	39	8	18	1.2	.2	0.2	<.01	<.1	0.6	.02	<.001
VAGABOND ESSO SERVICE	"		6.4	2.2	1.5	1220	695	111	32	357	13	.23	29	10	199	1.5	<.1	0.1	.04	1.5	1.7	.02	<.001



COMMUNITY OF GOGAMA

GROUND WATER SURVEY

NORTH

LEGEND

3387 Well Number

G 1 Sample Location

Recommended Test-Drilling Area

SCALE

1 cm. = 127 m.

FIGURE NO. 1 MARCH 1980